

**REMARKS/ARGUMENTS**RECEIVED  
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Claims 1-12, 14-18, and 23-38 were previously pending in this application. Claims 1, 2, 5, 6, and 26-28 have been amended and Claims 3 & 29-38 are newly cancelled. Claims 39-40 are added. Accordingly, Claims 1, 2, 4-12, 14-18, 23, 24, 26-28 and 39-40 are currently pending in the application.

**Claim Rejections under 35 U.S.C. 112:**

Claims 1 and 25-28 have been rejected under 35 U.S.C. 112, 1<sup>st</sup> & 2<sup>nd</sup> paragraphs as being unpatentable for being non-enabling, indefinite, and otherwise failing to comply with the written description requirement.

Claim 26 is cancelled thereby making moot any further discussion of this claim. Accordingly, applicants respectfully request that this ground of rejection be withdrawn as to cancelled Claim 25.

As to rejected Claims 1 & 26-28, the immediately following discussion applies. As discussed with the Examiner applicants believe that these claims as currently worded are supported by the specification. Accordingly, applicants respectfully traverse these rejections as discussed below.

The applicants have amended Claim 1 to more clearly specify selective ionization "by selectively photo-ionizing the vaporized metallic element or salt without ionizing the inert carrier gas". Such limitation is spelled out in great detail in the specification. Examples of language supporting this language include, but are not limited to, selective photo-ionization of metal and/or metal salts described at paragraphs [0020] & [0026]-[0029] and at other points in the Specification. This concept is greatly detailed in the Specification.

It is believed that the amended Claims are in compliance with the written description requirement as being well supported in the Specification and in compliance with the enablement requirement as also being well explained in the Specification. These points were discussed with the Examiner and clarified on October 19, 2006 telephonic discussion with the Examiner. Examiner Chen is kindly thanked for his acknowledgement of these points and also thanked for his guidance directed toward altering the claim language. Therefore, applicants respectfully

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submit that the foregoing remarks are sufficient to traverse the pending rejections and overcome the expressed grounds under 35 U.S.C. § 112, 1<sup>st</sup> & 2<sup>nd</sup> paragraph. Therefore, applicants respectfully request that this ground of rejection be withdrawn as to Claims 1 and 26-28.

Additionally, Claim 2 is been rejected under 35 U.S.C. 112, 1<sup>st</sup> & 2<sup>nd</sup> paragraphs as being unpatentable for being non-enabling, indefinite, and otherwise failing to comply with the written description requirement.

As to rejected Claim 2 the following discussion applies. As discussed with the Examiner applicants believe that this claims as now amended is supported by the specification. Accordingly, applicants respectfully traverse these rejections as discussed below.

The applicants discussed the idea of "atomic layer thicknesses" with the Examiner. The applicants point out that atomic layer thicknesses are very thin and very difficult to achieve. Only certain material treatments, temperatures, gradients and material densities can be used to attain these layers of thickness. Atomic layer thicknesses being inordinately thin "very thin layer, as thin as one or a few atoms" (Spec. at e.g., para. [0052] and elsewhere), they are not the thick layers taught in the cited art. Generally, the invention teaches a way of forming layers a single atom thing to about a dozen atoms thick. Such is what is meant by atomic layer thicknesses. Of course thicker layers could be formed by repeated iterations of the process if desired. But, in such cases older technologies can also be used.

Additionally, in order to explain certain patentable distinctions Claim 2 is amended to further include the limitation of "vaporizing a metallic element or metallic element salt ... using the previously heated inert carrier gas, ... and wherein the carrier gas is heated to a temperature at which the metallic element or salt of attains a vapor pressure of the at least 0.01 mTorr, thereby generating the vaporized metallic element or salt". This is supported in the Specification at many places including, but not limited to, ¶¶ [0033], [0040], [0041], [0051], and so on. This is important because it enables extremely low metal or salt densities in the ambient inert gas flow and very high temperatures for the gas/metal ambient or flow when it contacts a relatively cooler substrate enabling condensation of the metal onto the substrate in a very thin atomic layer thickness.

Thus, the applicants argue that the language of the amended Claim 2 is enabled, and not vague as to the claimed subject matter. All the expressed limitations are spelled out in great detail in the specification. And, accordingly, it is believed that the amended Claims comply with

both the 1<sup>st</sup> and 2<sup>nd</sup> paragraph requirements under 35 U.S.C. § 112. As discussed above, these points were discussed with the Examiner and clarified on October 19, 2006 telephonic discussion with the Examiner. Examiner Chen is kindly thanked for his acknowledgement of these points and also thanked for his guidance directed toward altering the claim language. Therefore, applicants respectfully submit that the foregoing remarks are sufficient to traverse the pending rejections and overcome the expressed grounds under 35 U.S.C. § 112, 1<sup>st</sup> & 2<sup>nd</sup> paragraph. Therefore, applicants respectfully request that this ground of rejection be withdrawn as to Claim 2.

**Claim Rejections under 35 U.S.C. 103:**

The Examiner has rejected **Claims 2-12, 14-18, & 29-38** under 35 U.S.C. 103 variously as unpatentable over *Oren et al.* (U.S. Pat. 4,742,022 hereinafter *Oren*) and *Kogai et al.* (U.S. Pat. 6,416,822 hereinafter *Kogai*). Applicants traverse these rejections as discussed below.

**Rejection Oren**

The Examiner has rejected **Claims 2-12, 14-18, & 29-38** under 35 U.S.C. 103 as being unpatentable over *Oren*. The applicants respectfully disagree with this contention for reasons explained below.

**Claims 3 & 29-38** are cancelled thereby making moot any further discussion of these claims. Accordingly, applicants respectfully request that this ground of rejection be withdrawn as to cancelled **Claims 29-38**.

**Claim 2** is amended. **Claims 5 and 6** are amended to make consonant with Claim 2.

As to remaining **Claims 2, 4-12 & 14-18**, the following discussion applies. First, the present invention embodies a method for heating and vaporizing a class of metal and metal salts for use in semiconductor deposition processing. This is particularly relevant to angstrom-scale processes adaptable to the formation of atomic layer thickness films (Specification at, for example, paragraph [0023],[0041],[0042],[0052] and so on). This goes far beyond the sensitivity available to a primitive and obsolete technology such as *Oren*.

This distinction should now be sufficiently amplified by the language added to amended Claim 2 "depositing the vaporized metallic element ... in *atomic layer thicknesses within the chamber*" (emphasis added).

And also, Claim 2 is amended to include "pre-heating ... an inert carrier gas" and "vaporizing a metallic element or metallic element salt ... using the previously heated inert carrier gas, ... and wherein the carrier gas is heated to a temperature at which the metallic element or salt of attains a vapor pressure of the at least 0.01 mTorr, thereby generating the vaporized metallic element or salt".

These limitations taken together present a wholly different invention from that suggested by the prior art.

The significance of atomic layer thicknesses in this context refers to layers one to a few atoms thick. As such we are speaking of layers of a dozen atoms thick or less. Such a process is not contemplated or even possible with the cited art which is directed to vaporizers used for fabrication of large scale deposits and crystal growth rather than the fabrication of monatomic layers or layers a few atoms thick. *Oren* is a gross large scale deposition and crystal formation process. This is a brute force coating method where atomic scale precision is of no particular concern. This is indirect contrast to the claimed invention. The Applicants refer the Examiner to paragraph [0023] (page 7) where it is pointed out that the claimed inventive deposition and vaporization techniques can be used to form layers of one or a few atoms thick.

Again the *Oren* uses an open tube furnace having flowed in inert gas. The gas is not preheated and is not used to vaporize the metal/metal salt. Simply a different approach.

The applicants respectfully submit that the cited art does not establish all elements of Claim 2 and accordingly fails to establish a *prima facie* case of obviousness.

These deficiencies of the cited art become even more pronounced when applied to the dependent Claims. In just one for example, the Examiner is directed to Claim 15. The cited art does not include any teaching of a deposition of calcium onto a silicon dioxide surface. The response is that one of ordinary skill would expect that other group two elements to behave similarly. That logic is expressly flawed. Using this logic all group two materials would be radioactive because Radium (another group II material) is radioactive. This is simply unsupported by the cited art. See, e.g., MPEP 2144.08, MPEP 2144.09 regarding analogous

materials. One classification that is useful for some of these materials is high vapor pressure at low temperature (See, Specification) that is not necessarily a property of other claimed materials. In order for the office to sustain an obviousness rejection based on a "analogous" material the Office is required to make findings as to:

- "(A) the structure of the disclosed prior art genus and that of any expressly described species or subgenus within the genus;
- (B) any physical or chemical properties and utilities disclosed for the genus, as well as any suggested limitations on the usefulness of the genus, and any problems alleged to be addressed by the genus;
- (C) the predictability of the technology; and
- (D) the number of species encompassed by the genus taking into consideration all of the variables possible."

No such findings were shown. This same discussion applies to may other claims like 8, 14, 15, and so on. Simply no *prima facie* case of obviousness has been made.

Accordingly, one of ordinary skill in the art would not look to obsolete technology to find an atomic layer deposition technology. There is no teaching or suggestion that such a technology can even be applied to semiconductor processing with ANY expectation of success at all. Accordingly, one of ordinary skill in the art would not achieve the claimed invention using the cited art. This is in fact made quite clear in the action where no direct application of the cited art to ANY dependent claims is made. In other words no case is made in the Action that the claimed invention is obvious in view of cited art.

Claims 4-12 and 14-18 all depend from Claim 2, and therefore, for at least the reasons advanced in support of Claim 2, are also believed to be allowable. Additionally, each of these dependent claims is believed to be allowable for reasons further absent the cited art. However, as stated previously, due to the present allowability of these claims no further discussion of these claims is necessary at this time. The applicants therefore respectfully request that this ground rejection be withdrawn as to Claims 2-12, and 14-18.

#### Rejection Kogai

Claims 2-12, 14-18, & 29-38 stand rejected under 35 U.S.C. 103 as being unpatentable over Kogai. The applicants respectfully disagree with this contention for reasons explained below.

Claims 3 & 29-38 are cancelled thereby making moot any further discussion of these claims. Accordingly, applicants respectfully request that this ground of rejection be withdrawn as to cancelled Claims 29-38.

Claim 2 is amended. Claims 5 and 6 are amended to make consonant with Claim 2.

As to remaining Claims 2, 4-12 & 14-18, the following discussion applies. First, the present invention embodies a method for heating and vaporizing a class of metal and metal salts for use in semiconductor deposition processing. This is particularly relevant to angstrom-scale processes adaptable to the formation of atomic layer thickness films (Specification at, for example, paragraph [0023],[0041],[0042],[0052] and so on). This goes far beyond the sensitivity available to a primitive and obsolete technology such as *Kogai*.

This distinction should now be sufficiently amplified by the Claim 2 language reciting "depositing the vaporized metallic element ... in *atomic layer thicknesses within the chamber*"(emphasis added).

And also, Claim 2 is amended to include "pre-heating ... an inert carrier gas" and "vaporizing a metallic element or metallic element salt ... using the previously heated inert carrier gas, ... and wherein the carrier gas is heated to a temperature at which the metallic element or salt of attains a vapor pressure of the at least 0.01 mTorr, thereby generating the vaporized metallic element or salt".

These limitations taken together present a wholly different invention from that suggested by the prior art.

The atomic-scale processes adaptable to the formation of atomic layer thickness films recited in the present Claim 2 go far beyond the sensitivity available to a technology such as *Kogai* which distributes particulate zinc rather than atomic layers of material. This distinction is embodied in the claim language reciting "depositing the vaporized metallic element ... in atomic layer thicknesses". Such a process is not contemplated or possible with the cited art which is directed to vaporizers directed to the fabrication of large scale deposits (particulates (*Kogoi* 4:50-55, 8:44-49, 8:65-67); tetrapod shaped particulates (*Kogoi* 7:24-30, 7:55-60, 8:20-27) and crystal growths rather than the Ångstrom level fabrication of monatomic layers or layers a few atoms thick.

Additionally, the recited limitations of "pre-heating ... an inert carrier gas" and "vaporizing a metallic element or metallic element salt ... using the previously heated inert carrier gas, ... and wherein the carrier gas is heated to a temperature at which the metallic element or salt of attains a vapor pressure of the at least 0.01 mTorr, thereby generating the vaporized metallic element or salt" are absent from *Kogai*. Accordingly, the applicants believe, for at least these reasons, that the cited *Kogai* reference is insufficient to establish a *prima facie* case of obviousness as to Claim 2.

Claims 4-12 and 14-18 all depend from Claim 2, and therefore, for at least the reasons advanced in support of Claim 2, are also believed to be allowable. Additionally, each of these dependent claims is believed to be allowable for reasons further absent the cited art. However, as stated previously, due to the present allowability of these claims no further discussion of these claims is necessary at this time. The applicants therefore respectfully request that this ground rejection be withdrawn as to Claims 2-12 and 14-18.

**New Claims:**

Claims 39-40 are new drafted with the intention of clarifying the language "atomic layer thicknesses". Here they recite "layers of one to a few atoms thick" or a layer of "one atom thick" respectively.

**Conclusion:**

In view of the foregoing amendments and remarks, it is respectfully submitted that the claimed invention as presently presented is patentable over the art of record and that this case is now in condition for allowance.


Accordingly, the applicant requests withdrawal of all pending rejections and requests reconsideration of the pending application and prompt passage to issuance. The applicant further clarifies that any lack of response to any of the issues raised by the Examiner is not an admission by the applicant as to the accuracy of the Examiner's assertions with respect to such issues. Accordingly, applicant specifically reserves the right to respond to such issues at a later time during the prosecution of the present application, should such a need arise.

Additionally, if any additional fees are due in connection with the filing of this Amendment, the Commissioner is authorized to deduct such fees from the undersigned's Deposit Account No. 12-2252 (Order No. LSH1P212).

As always, the Examiner is urged to telephone the applicant's representative to discuss any matters pertaining to this case. Should the Examiner wish to contact the undersigned for any reason, the telephone number set out below can be used.

Respectfully submitted,

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